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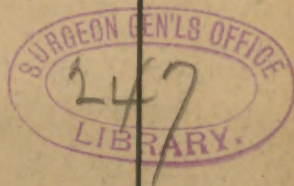
MR. LISTER'S ANTISEPTIC METHOD

BY

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### MR. LISTER'S ANTISEPTIC METHOD.

Nine years have passed since Mr. Lister began to use the spray engine and carbolized gauze in the dressing of surgical wounds and injuries. For several years previous to 1871 he had been experimenting with carbolic acid in surgical dressings, but the introduction of his method, as it stands, dates from that year. The story of its fortunes must be familiar to all. Like other surgical novelties, it found some ready and even eager to test it, some disposed to deny the correctness of the principles upon which it is based, and many, whose enthusiasm had been chilled by frequent disappointments, simply indifferent to its unverified claims. This period of indifference or mild interest did not last long. Isolated reports of remarkable successes obtained by its aid appeared in the journals; hostile criticism, which in some cases seemed to have its origin in personal rivalry and competition, stimulated inquiry; and towards the end of the year 1872, a German surgeon who was on the point of closing his wards on account of the frightful mortality in them from pyæmia and erysipelas, determined as a last resource to give the method a trial. His success with it was immediate and unquestionable. During the fifteen months following its adoption 716 patients were received into the hospital, and 4,000 treated as "out-door" patients; among these, traumatic erysipelas occurred eight times, pyæmia three times, and septicæmia once under the Lister dressing; there was not a single



case of acute diffuse phlegmon or purulent œdema; thirty-one cases of compound fracture of the limbs were treated conservatively without a single death, whereas previously, twelve out of sixteen such injuries to the leg treated by the open method had terminated fatally.

Similar testimony came from other quarters, and in 1876 the general belief in the value of the method and the recognition of the merit of its originator, were shown in his selection as President of the Surgical section of the Medical Congress which met in Philadelphia that year. In 1877, he was called to London and appointed Surgeon Extraordinary to the Queen, and Professor of Surgery at King's College, taking the place made vacant by the death of Sir William Fergusson.

With general interest in the method came general discussion of its details and the causes of its success. Modifications of all kinds were introduced; by some as avowed partisans, by others who accepted its central idea but thought many of its minutiae unnecessary; and by some, less generously perhaps, to approximate it to older methods and show that its good results were due to causes not suspected by the author. Borax, salicylic acid, thymol, were in turn substituted for carbolic acid, washing of the wound with a strong solution at the end of an operation was made to do duty for the use of the spray during it, lint wet with carbolized oil took the place of the gauze, and the simple addition of daily washings with carbolic acid was claimed by some to be all that was necessary to make an old method equal to the new.

A new term corresponding to the new method made its appearance in surgical literature. The followers of Mr. Lister saw in putrefaction the source of all preventable surgical complications, and their effort therefore was to prevent putrefaction. Theirs was *antiseptic surgery*. Against this restriction of the term many have protested, and Mr. Savory in his brilliant address before the British Medical Association last summer, regretted the confusion in the current employment of the phrase. According to his view, all surgery is antiseptic which aims to secure speedy repair and healthiness of wounds "by the most scrupulous cleanliness, not

only in the common, but in the surgical sense, which means the prevention or removal or destruction of all matter which may prove poisonous." As thus understood, he says, the term is simply equivalent to "good surgery," and is therefore superfluous. Upon this point we venture to differ from him. Antiseptic surgery, as generally understood, aims at the absolute prevention of putrefaction, not at the mere removal of its products; and although Mr. Savory's surgery may be as "good" as Mr. Lister's, we certainly need a term to distinguish between the widely different methods by which the respective results are obtained, and what term can be more appropriate than the one which indicates the principle involved.

The question of the comparative excellence of the results has been warmly debated, and Mr. Lister's opponents have found a formidable argument in the fact that his statistics have not hitherto been published. To the report of remarkable cases, of new operations successfully carried out, they reply that statements of this kind have never been wanting in favor of any novelty; and Mr. Bryant, referring to this, has said somewhat harshly that "the publication of isolated cases, however good, proves nothing, whereas the withholding of the whole suggests much." To published German statistics English surgeons have replied that the results could be considered good only by comparison with the inexcusably bad ones previously obtained in the same hospitals, and that they were actually much inferior to those obtained by themselves by other methods.

In support of this statement, Mr. Savory presented in the address above referred to, a tabulated report of the cases of blood-poisoning that had followed injury or operation, during a period of three years at St. Bartholomew's Hospital. We condense the tables as follows:

	Total Cases.	Percentage of Deaths.	Pyæmia.		Erysipelas.		Percentage of Blood-poisoning.	
			Cases	Deaths	Cases	Deaths	Cases	Deaths
INJURY . .	2862	7.47	6	6	22	4	1.05	0.42
OPERATION	1235	5.82	11	10	38	8	3.96	1.44



All the operations included in these tables, he says, were of some magnitude ; most of them were capital ones ; trivial operations and those for hernia, ovariectomy, and on the eye, were for obvious reasons excluded.

While Mr. Savory and his three colleagues differed in regard to certain details of treatment, they were entirely in accord as to the chief objects in view. "Cleanliness in the surgical sense, and rest in the physiological sense, may be said to be the leading aims." They watch the actual condition of the wound very carefully, and use freely antiseptics of various kinds. Constant attention is paid to keeping the air of the wards pure and free from any suspicious odor ; they avoid any tendency to overcrowding of wounds in a ward, and, finally, they attach the highest importance to the condition of the patient before operation. Mr. Savory's own practice, as illustrated in the amputation of a breast or of a limb, is as follows : All hemorrhage is carefully arrested, usually with the carbolyzed cat-gut ligature ; blood clots are removed from the surface of the wound by means of clean water or sponges just rinsed out of it ; the edges are brought together with silk sutures placed at intervals of one or two inches. If the patient is old, in poor condition, or fat, and there is reason to anticipate free discharge, he inserts one or two thin strips of gutta serena or threads of cat-gut into the wound. Then a layer of lint soaked in oil containing two per cent. of carbolic acid is placed over the wound ; over that again two or more layers of dry lint, with or without cotton wool, so arranged as to secure by gentle and equable pressure accurate coaptation of the cut surfaces, and made fast by strapping or bandages so placed that they can be removed with the least disturbance. Usually this dressing is not disturbed for forty-eight hours. If, on examination, the wound is found in a satisfactory condition, the dressing is repeated as before ; if there is any evidence of retention of the discharges, he relieves it by carefully separating the edges of the wound with a clean probe, or by removing one or more stitches ; if the discharge becomes at all profuse, if the edges do not remain in contact, or if they show a blush or much

tension, he substitutes a bread and water poultice for the previous dressing, and continues it until the deeper portion of the wound has closed, washing the wound at each dressing with tepid water containing permanganate of potash, or some other powerful and unirritating antiseptic.

To this address and these statistics Mr. Lister replied with a detailed account of 32 cases of operations upon, or injuries to joints, prepared by Mr. Watson Cheyne, and published in the *British Medical Journal*, November 29, 1879, and with a *résumé* of the results obtained by him at the Royal Infirmary of Edinburgh between November, 1871, and August, 1877, the latter being presented at a meeting of a branch of the British Medical Association, held at St. Thomas's Hospital, December 3, 1879. His list, tabulated to correspond with Mr. Savory's, is as follows :

	Total	Deaths		Deaths by Blood-poisoning	
	Cases	No.	Per cent.	No.	Per cent.
INJURY . . . . .	72	4	5.7	0	0
MAJOR OPERATIONS .	725	37	5.1	6.	0.82

Of the operations, 292 were for various reasons not treated antiseptically, and these gave 4 deaths by blood-poisoning ; the remaining 553 cases treated antiseptically give only 2 deaths by blood-poisoning, one of them due to pyæmia after amputation of the breast, the other due to erysipelas.

The excellence of these results, both absolute and relative, cannot be questioned ; but their value would be enhanced by a knowledge of the details of each fatal case, for, as Mr. Savory eloquently said, in the keen and noble rivalry which has sprung up between surgeons and institutions to reduce mortality due to blood-poisoning to the lowest possible terms, the judgment will be swayed by the desire, and in the anxiety to escape what has happily become almost the disgrace of the occurrence of blood-poisoning in any case under one's care, the signs of it are rather open to be misinterpreted, or explained away, or called by some

other name. Thus it would be interesting and valuable to know the causes of death in the three cases of spina bifida and one of hydrocephalus, treated by Mr. Lister by the introduction, under antiseptic precautions, of two or three horsehairs, all of which terminated fatally, but in none of which is the death charged to blood-poisoning. Certainly, if the deaths were in any way attributable to the operation the fact should be made known, both in the interests of science and to check the manifest and growing tendency to believe that antiseptic precautions justify recourse to operative interference in cases and under conditions where heretofore it has been considered entirely unwarrantable. If those four deaths were due to the interference, Mr. Lister's mortality from preventable causes rises from 6 to 10, and the percentage equals Mr. Savory's. In like manner it may well be doubted whether Mr. Lister's confidence in his method did not lead him to make three amputations at the hip-joint and one at the shoulder, which another surgeon would not have made, and all of which terminated in speedy, almost immediate, death. One of them was for "an enormous fibroma," a benign tumor; two were for injury, and the patients were in collapse at the time of the operation; of the remaining one he says: "I operated for myeloid disease of the thigh-bone. The bone looked sound when I divided it; but on microscopic examination there appeared to be disease, and I amputated the next day at the hip-joint. The patient died in twenty-four hours." It is true, as he claims, that these deaths are not to be taken into account in estimating the power of a dressing to prevent blood-poisoning; but if the operations were inspired by confidence in the dressing, one death certainly, and probably two, are as fairly chargeable to it as if they had been caused by pyæmia developed under it. As to the other two, it may be said that death would have occurred in any case; but that is not a reason for operating, and such interference needlessly compromises our art.

We turn to Mr. Lister's cases of injuries to and operations upon joints with a feeling of almost unmixed satisfaction and pride in his success. The qualification is due to the presence in



this list also of one, possibly of three, operations out of a total of twenty, where the interference, although entirely successful, will be looked upon by many as of doubtful propriety. In one case a ganglion was removed from each wrist, the sheaths of the tendons and one wrist joint being freely opened. In another, partial excision of the elbow joint was done on account of a badly united fracture of the humerus which prevented extension of the forearm beyond an angle of  $120^{\circ}$ ; and in a third a transverse fracture of the patella was treated by opening the joint and wiring the fragments together. Leaving aside this question of the propriety of interference which arises in only a few of the cases, the general results are excellent. In thirty-one of the thirty-two cases of operation or injury the treatment was entirely successful, except that in two cases the joint remained stiff, and in one, an ununited fracture of the neck of the femur, union did not take place, although pain was relieved. The solitary failure followed an attempt to save a badly crushed wrist and hand; putrefaction occurred, and a partial amputation was done. Among the twelve cases of injury were two compound fractures communicating with the elbow joint, two compound dislocations of the ankle, one compound fracture of the femur communicating with the knee joint, one punctured wound of the ankle, and two wounds of the knee joint, one of them being a large lacerated wound with mud ground into the articular cartilage of the femur. In only one of these cases is it mentioned that the temperature rose to  $100^{\circ}$  F.

Such a series of good results has, we believe, never before been obtained. Mr. Bryant, commenting upon it, says, "Equally good cases might be got out of the ordinary book of the hospital surgeon;" but that assertion is too indefinite to carry much weight. Undoubtedly as good results have been obtained in single cases, but until another such integral record is published this one must be considered unequalled.

Space does not permit a prolonged examination of the many interesting points connected with this subject, but it may be profitable to consider some of them for a moment. In the first place, all agree, opponents as well as partisans, in recognizing the

gain to surgery from the improved methods in the treatment and care of wounds that have been the direct outcome of the introduction and discussion of this method. Whether the theory and practice will win universal acceptance, or share the fate of so many surgical novelties, Mr. Lister will still rank among the great benefactors of his kind. The importance of keeping wounds clean and at rest, of thorough drainage, and of cat-gut ligatures, has been impressed upon us in such a way that it is not likely to be again forgotten or neglected. We have learned that it is possible in great hospitals to habitually obtain speedy union after major amputations without increasing the risk of pyæmia by the attempt, and to save both life and limb after compound fracture with penetration of a joint. Operations which were formerly thought to involve too much risk to life are now frequently and safely performed; while, on the other hand, this increased security has perhaps led to the too ready substitution of the knife for equally good non-operative or less severe measures.

The Lister method, employed in its purity and with all its details, has proved itself able to practically abolish pyæmia, hospital gangrene and erysipelas from large, ill-conditioned, infected hospitals, where, previous to its introduction, these diseases attacked almost every wounded patient. Volkmann's experience alone is a sufficient proof of this, but it is corroborated by Nussbaum's in a manner which also shows that the previous existence of these diseases was not due to the carelessness of the surgeon. Nussbaum had two hospitals, a large public one in Munich and a smaller, though still large, private one just outside the city. The latter was kept almost free from hospital disease, while the most earnest efforts, including the use of various antiseptics and the open treatment, failed to purify the former. At last the Lister method was introduced, and its introduction was followed by the almost total disappearance of septic complications.

Now, while these facts impose upon a surgeon the moral obligation to employ the Lister method under similar circumstances, or in the place of any personal method which fails to yield an equally high percentage of successes, they do not necessarily

prove the correctness of Mr. Lister's views concerning the origin of wound complications, or the agency to which the efficiency of his dressing is due. His theory, and in the heat of the discussion over the details it appears to have been accepted almost without question in England and Germany, is that putrefaction of the wound secretions is the one active and efficient cause of the complications which he seeks to avoid, and that its action depends directly upon the absorption of its products, upon their introduction into the circulation through the blood-vessels of the raw or granulating surface. This putrefaction being set up solely by the agency of germs brought to the wound from without, the details of the dressing are designed to prevent their deposit upon it or to destroy them. It is claimed that the spray destroys all germs floating in the air, and therefore it is employed during the exposure of the wound at the time of the operation and at the subsequent dressings, while the carbolic acid contained in the gauze is relied upon for protection during the intermediate periods.

Of the four principal assertions upon which the method rests, two lack a demonstration. These are: the agency of putrefaction in the origin of blood-poisoning, and the power of the spray to purify the air. We have elsewhere\* given reasons based upon experimentation for doubting the possession of this power by the spray, and Mr. Lister's own records show clinically that as good results can be obtained without its use as with it. He reports thirty-three cases of compound fracture and seven of wounded joints; these wounds were of course received without the protection of the spray, and their primary disinfection was sought by washing them out with a solution of carbolic acid in water or in alcohol, and yet they furnished not a single death by blood poisoning. Their record in this respect is even better than that of the operations where the spray was used, and it certainly seems, therefore, as if the use of the spray might be dispensed with. Mr. Cheyne, indeed, speaks of it as the least important of all the precautions, but apparently Mr. Lister does not hold the same

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\* *Am. Journal of Medical Sciences*, January, 1880.



opinion, for he attributes the occurrence of pyæmia in his fatal case of amputation of the breast to the misdirection of the spray, apparently during one of the dressings.

That putrefaction of the wound secretions is the sole or most common cause of blood-poisoning is not only not proven, but the weight of evidence is against it. We cannot here do more than mention the grounds upon which this statement is based. They are of two kinds: 1st, those which indicate another cause; 2d, those which show the comparative harmlessness of the products of putrefaction.

The contagiousness of erysipelas, its frequent independence of an open wound, and its occurrence about slight wounds or those that have nearly healed, give it a character entirely distinct from pyæmia or septicæmia, and indicate a cause independent of putrefaction.

In like manner, the contagiousness of pyæmia, its comparative limitation to crowded surgical wards, its greater frequency in the winter, and its relatively tardy appearance, are not compatible with the theory of a causative putrefaction; while its rarity after simple wounds, its frequency after those that are associated with much laceration and bruising of the tissues, and its more common occurrence (other things being equal) in those reduced by habitual exposure or dissipation, point towards an auto-production of the poison dependent upon altered vitality of the tissues involved in the injury.

Another variety of blood-poisoning, characterized by a rapid onset and extreme severity, is seen especially in military surgery, under physical conditions which are not only unfavorable to the origin and spread of a putrefactive process, but are also generally considered almost a guarantee against septic complications. Soldiers exhausted by forced marches and dispirited by defeat, operated upon in the open air, lying in tents or farm-buildings, often at seasons when everything is frozen, furnish an enormous percentage of mortality from this cause, and die even before their wounds have begun to suppurate. During the siege of Paris the mortality after operations was unparalleled; Nélaton lost 68 out of

70 amputations at the Grand Hotel ; Guérin saw almost every amputation at St. Louis end fatally until during the subsequent Commune, when he began to envelope his stumps in thick layers of cotton and leave them undisturbed for weeks. Under that treatment his patients recovered, although they were men and women exhausted by the privations of a five months' siege during an exceptionally inclement season, frenzied by drink and passion, and suffering from gunshot injuries, and although putrefaction went on so actively under the dressings that the odor in the wards was very offensive. It must be remembered, too, that at that time he made no attempt to get primary union ; he filled the wound with cotton and left it to granulate from the bottom. Its whole surface was bathed for weeks in fetid pus, and yet poisoning did not occur.

It is well known that the danger of *post-mortem* inoculation, itself a septicæmic affection, varies with the cause of death, being greatest after puerperal or surgical poisoning ; and in these and other cases it diminishes with the appearance and progress of putrefaction. Men with open cuts upon their hands can handle putrid matter with comparative impunity, while Sir James Paget was poisoned almost fatally by absorption through the unbroken skin of his hands of the virus of a puerperal peritonitis.

Experimentation has shown that to render a rabbit septicæmic injections of 10, 20, even 30 drops of putrid blood are required, and even these are not uniformly successful ; but the desired effect can be produced speedily and certainly by the injection of the millionth part of a drop of fresh blood taken from another animal dying, or just dead, of septicæmia. Moreover, if this latter blood is allowed to putrefy, it loses its virulence.

Vulpian produced by the injection of a small amount of the extract of bitter-sweet under the skin of a frog a septicæmia identical with that produced by the similar injection of a true septicæmic virus ; and he got a like result from the action of a corrosive substance, cyclamine, upon the œsophagus.

By exciting an acute attack of indigestion, a German pathologist asserts that he has recently caused pyæmia and putrefaction

of the discharges of the wound in dogs recovering under antiseptic treatment from injuries to their bones ; and although too much importance is not to be attached to these isolated and unverified experiments, they nevertheless deserve mention.

Pasteur, whose statements are always to be received with respect, has described a septic vibrio that is entirely distinct from the vibrio of putrefaction, and a vibrio of purulent infection (pyæmia) which somewhat resembles the latter. These vibrios are found in abundance in ordinary water and in the air in the form of corpuscle-germs ; and he claims that the only reason why they do not seriously complicate every wound is that the vital action of the tissues is unfavorable to their development and multiplication. The virulence of the septic vibrio depends greatly upon the liquid in which it has been developed, and after having been greatly diminished by successive cultivations in one kind of liquid it may be so promptly restored by a single cultivation in another that  $\frac{1}{20000}$ th part of a drop will kill, and the blood or serum of the animal thus killed has a virulence infinitely greater still.

Finally, it is a fact daily observed that purulent collections of extreme fetidity may exist in the body without giving rise to blood-poisoning ; the commonest example, perhaps, is found in abscesses of the ischio-rectal fossa.

It is evident, then, that there is something to be guarded against in the treatment of wounds besides putrefaction, and this something is in the nature of a specific poison which, there is reason to believe, may be generated in the body *de novo*, and which certainly is transmissible. This view harmonizes apparent clinical contradictions, and explains the success of different methods of treatment as the theory of putrefaction cannot do. There is nothing in it incompatible with the belief that putrefaction may be positively injurious, either by furnishing a suitable nidus for the development of specific germs, or by so modifying adjoining tissues whose vitality is already compromised as to turn the scale in favor of the occurrence of an actively poisonous process therein. According to it the Lister dressing acts by destroying specific germs that fall upon the wound during the operation, by



preventing the arrival of others subsequently, and by drainage, rest, equable pressure, and the absence of ligatures; and when these conditions are realized by other means, equally good results may be expected

LEWIS A. STIMSON.











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